

Original Research Article

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Effect of Feeding Neem and Papaya Leaf Meal as Feed Additive on Carcass Characteristics and Economics of Broilers

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ABSTRACT

Keywords

Broilers, Neem leaf meal, Papaya leaf meal, Carcass characteristics and Economics

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The study was conducted to investigate the effect of supplementing neem and papaya leaf meal, individually and in combination on carcass characteristics and economics of broiler production. 220, day-old Cobb commercial broiler chicks were randomly divided into 11 treatments with 4 replicate having 5 chicks in each. In treatment groups along with basal diet, neem and papaya leaf meal were incorporated in the diet at two different levels, individually (0.5 and 1.0% of diet) and in three different combinations (1:1, 1:2 and 2:1 part of NLM and PLM @ 1.0 and 2.0% of diet). Experiment was conducted for 6 weeks. At the end of trial (42 days), 02 birds from each replicate were sacrificed for performing carcass traits. Economics of broiler production was calculated as feed cost/kg body weight gain for total period. Carcass characteristics of broilers had shown significant ($P < 0.05$) superiority in treated groups. No specific trend was observed across dietary treatments, in weight of organs and processing losses. Better feed cost/kg weight gain was observed in broilers fed on diets supplemented with neem and papaya leaf meal in a 1:1 ratio at 1.0% of the diet. It could be concluded that supplementation of neem and papaya leaf meal in 1:1 ratio at 1.0% of diet results in more healthy broilers.

Introduction

Poultry production is important for the socio-economic development of any country and has ability to provide animal protein at shorter duration. There are many protein sources for human consumption but in view of ever rising demand of high protein; broiler production can serve as an alternative potential source to meet this burgeoning demand. The birds are ready for market and human consumption

within 6-8 weeks period. It results in fast return of farmer's investment. As a result of this, collaborative efforts are required to discover ways and means to increase animal production to bridge the deficit in animal protein intake (Rahman *et al.*, 2015). Many synthetic drugs like antibiotics and growth promoters are supplemented as a feed additive to broilers for their rapid growth. Their use has generated some positive and negative effects over the years and has redirected

research to natural antimicrobial products. Feed additives like antibiotics and others use in broiler have residual effect and thereby causing serious health hazards in humans when consumed (Mali *et al.*, 2020). It is evident that herbal agents are safer replacements as growth promoters because of their suitability, preference, lower production cost, reduced risks, toxicity and least health hazards (Kamal *et al.*, 2015). Phytogenic feed additives are eventually gaining prominence in improving chicken performance and can boost their immune response (Oloruntola *et al.*, 2016). In broilers, using leaf meal as feed constituents has been studied long (Wyllie and Chamanga, 1979). Leaf meals are well-defined as dried and pounded products of plant leaf.

Neem tree, *Azadirachta indica* is among the most examined tree in the world and has concerned world-wide importance due to its immense range of medicinal properties like antibacterial, antiviral, antiprotozoal, antifungal, hepatoprotective and various other properties, without showing any opposing effects (Kale *et al.*, 2003). Whereas papaya tree, *Carica papaya* are natural source of papain, chymopapain A and B, and papaya peptidase A. Papain is proteolytic in nature and consequently capable of increasing protein digestion (Oloruntola *et al.*, 2018). Additionally, papaya leaf contains broad spectrum phytochemicals (including alkaloids and phenols).

Phenolic compounds have high antioxidant activity and free radical scavenging capacity, with the mechanism of inhibiting enzymes responsible for reactive oxygen species production (Kähkönen *et al.*, 2001). The antibacterial, antifungal, antiviral and neuroprotective activities of papaya have also been recognized (Kadiri *et al.*, 2016). Neem and papaya leaves (*Azadirachta indica* and *Carica papaya*) are considered to be the rich

source of active ingredients which are important for growth of broilers (Adeyemo and Akanmu, 2012). Also, they are found abundantly in India and are easily available.

It is apparent that they could be used in broiler chicken feed as supplement with its beneficial nutritive and phytogenic potentials. It is hypothesized that NLM and PLM supplementation may improve beneficial effect by improving carcass characteristics and economics of broiler production. Keeping this in view, the present experiment was carried out to study: (1) Effect of neem leaf meal (NLM) and papaya leaf meal (PLM) supplementation on carcass yield of broilers; (2) Effect of NLM and PLM supplementation on economics of broiler production.

Materials and Methods

Birds, Housing, and Experimental Design

The present experiment was conducted in the Department of Animal Nutrition, College of Veterinary Science and Animal Husbandry, Jabalpur (M.P.). Experimental chicks were raised in the battery brooder house. Total of 220, one day old VANCOBB broiler chicks were randomly selected for the experiment and were allotted eleven dietary treatments. Each treatment consisted of four replicates with five chicks in each.

The ingredients were procured in one lot for whole experiment. They were grinded and screened properly to get uniform particle size for formulation of diets. NLM and PLM were airdried; powdered separately and stored in air-tight bags. In the entire study uniform condition of housing, brooding, feeding and watering was maintained for all the groups of the experiment.

Eleven isonitrogenous and isocaloric dietary treatments was as follows: T0- Control

(Standard broiler diet / basal diet); as per commercial chick feed specification, T1- basal diet + neem leaf meal @ 0.5% of diet, T2- basal diet + neem leaf meal @ 1.0% of diet, T3- basal diet + papaya leaf meal @ 0.5% of diet, T4- basal diet + papaya leaf meal @ 1.0% of diet, T5- basal diet + 1:1 combination of neem leaf meal and papaya leaf meal @ 1.0% of diet, T6- basal diet + 1:1 combination of neem leaf meal and papaya leaf meal @ 2.0% of diet, T7- basal diet + 1:2 combination of neem leaf meal and papaya leaf meal @ 1.0% of diet, T8- basal diet + 1:2 combination of neem leaf meal and papaya leaf meal @ 2.0% of diet, T9- basal diet + 2:1 combination of neem leaf meal and papaya leaf meal @ 1.0% of diet and T10- basal diet + 2:1 combination of neem leaf meal and papaya leaf meal @ 2.0% of diet. The composition of feed ingredients used in the experiment is presented in Table 1 and Proximate Composition of NLM and PLM (on % DM Basis) in Table .

Carcass traits

To study the carcass traits, two broilers (in each replicate) were slaughtered on end of research period. Broilers kept off feed (for twelve hours) before slaughter. Throughout this whole period, clean and fresh drinking water were provided ad-libitum. Before slaughter, broilers were weighed and then by giving cut to the jugular vein and then permitted to bleed completely.

On the iron rails birds were hanged in upturned position for complete bleeding,. After complete bleeding, weight was noted. Then weight was again recorded after manual defeathering, for this hot water used (50-55°C). The dressed weight was then recorded as follows:

Dressed weight = Live weight - Weight loss as blood, head, feathers, shank and wing tips

After recording dressed weight, horizontal cut was given posterior to keel bone. Breast was pushed frontward to expose viscera and then pulled out. Weight of carcass was recorded again. Various visceral organs like liver, heart, gible, gizzard and pancreas were weighed. The eviscerated weight was then recorded as follows:

Eviscerated weight= Dressed weight - Weight of viscera

The drawn weight was then recorded as follows:

Drawn weight = Eviscerated weight + Weight of gible

Various processing losses such as blood, feathers, head, shank, separable fat and wing tips were recorded replicate wise during the study.

Organs weight

The organs (liver, heart, gizzard, spleen and pancreas) collected replicate wise at the time of slaughter and their weight was recorded during the experiment.

Economics of production

Economics of broiler production over feed cost was calculated as per cost of feed consumed and per kg weight gain for each dietary treatment.

Statistical analysis

Statistical analysis of the data was done by analysis of variance using completely randomize design (CRD) as per Snedecor and Cochran (1994). Differences among the treatments were tested for significance by Duncan's Multiple Range Test (1955).

Results and Discussion

Effect of supplementation of neem and papaya leaf meal on carcass yield (% of live weight) of broilers

Treatment means of carcass yields in terms of percentage live weight showed that when broilers were fed on diets supplemented with neem and papaya leaf meal individually and in combination, their dressing yield,

eviscerated weight and drawn weight in terms of percentage live weight of broilers influenced significantly. Present study demonstrates that birds fed on neem and papaya leaf meal in the ratio of 1:1 at 1.0% of total diet (T5) showed (P<0.05) superiority in carcass characteristics of broilers as compared with control group. Increased dressing percentage value indicates higher edible meat obtained from birds fed specific treatment diet (Table 3).

Table.1 Ingredient composition of broiler experimental diets

Feed Ingredients	Experimental Diets (%)		
	Pre-starter (0 - 14 days)	Starter (15 - 28 days)	Finisher (29 - 42 days)
Maize	55.21	57.33	59.27
Soybean meal	38.83	35.10	31.52
Calcite/LSP	0.62	0.66	0.69
DCP	1.65	1.64	1.63
Vegetable oil	2.28	3.91	5.60
Methionine	0.22	0.22	0.21
Lysine	0.28	0.28	0.22
Soda Bicarb	0.10	0.10	0.10
Salt	0.24	0.22	0.20
Trace Mineral Premix ¹	0.06	0.05	0.05
Vitamin Premix ²	0.06	0.05	0.05
Threonine	0.075	0.05	0.02
Maduramicin	0.00	0.00	0.05
Robimidine	0.033	0.033	0.00
Choline Chloride 60 %	0.10	0.12	0.15
Liver tonic	0.05	0.05	0.05
Emulsifier	0.05	0.05	0.05
Toxin binder	0.10	0.10	0.10
Supplemental ingredient	+	+	+
TOTAL	99.99	99.99	99.99

Trace mineral provided per kg diet: Manganese, 120mg; Zinc, 80mg; Iron, 25mg; Copper, 10mg; Iodine, 1mg; and Selenium, 0.1mg

² Vitamin premix provided per kg diet: Vitamin A, 20000IU; Vitamin D3, 3000IU; Vitamin E,10mg; Vitamin K,2mg; Riboflavin, 25mg; VitaminB1,1mg; Vitamin B6, 2mg; Vitamin B12,40mcg and Niacin, 15 mg

+ Varying level of NLM and PLM supplement

Table.2 Proximate Composition of NLM and PLM (on % DM Basis)

Nutrient Composition (%)	NLM	PLM
Moisture	8.27	11.73
Crude Protein	19.25	24.79
Crude Fibre	15.78	7.64
Ether Extract	5.02	1.70
Ash	6.50	8.94

Table.3 Carcass yields (% of live weight) of broilers in different treatment groups

Treat.	Parameters		
	Dressed weight (%)	Eviscerated weight (%)	Drawn weight (%)
T0	76.46 ^{de}	70.89 ^{de}	75.13 ^{de}
T1	78.89 ^{bc}	72.79 ^{bcd}	77.24 ^{bcd}
T2	80.16 ^{ab}	74.54 ^b	79.10 ^b
T3	79.83 ^{abc}	74.46 ^b	78.36 ^{bc}
T4	77.93 ^{cd}	72.05 ^{cd}	76.30 ^{cde}
T5	81.23 ^a	76.68 ^a	80.23 ^a
T6	78.35 ^{bc}	72.69 ^{bcd}	76.31 ^{cde}
T7	78.22 ^{cd}	73.25 ^{bc}	77.13 ^{bcd}
T8	78.77 ^{bc}	73.42 ^{bc}	77.94 ^{bc}
T9	79.26 ^{bc}	73.27 ^{bc}	78.17 ^{bc}
T10	75.52 ^e	69.71 ^e	74.63 ^e
SEM	0.36	0.41	0.37

Means of column with different superscript differ significantly (P<0.05)

Table.4 Organs weight (% of dressed weight) of broilers in different treatment groups

Treat.	Parameters (%)					
	Heart	Gizzard	Liver	Spleen	Pancreas	Giblet
T0	0.82 ^{ab}	1.87 ^{bc}	2.71	0.24 ^a	0.26 ^b	5.26 ^{abcd}
T1	0.70 ^{bc}	2.27 ^{ab}	2.62	0.09 ^c	0.29 ^b	5.53 ^{abc}
T2	0.84 ^a	2.36 ^a	2.55	0.10 ^{bc}	0.32 ^b	5.77 ^{ab}
T3	0.66 ^c	1.95 ^{abc}	2.35	0.12 ^{bc}	0.30 ^b	5.00 ^{bcd}
T4	0.74 ^{abc}	2.20 ^{ab}	2.57	0.11 ^{bc}	0.46 ^a	5.56 ^{abc}
T5	0.65 ^c	1.67 ^c	2.16	0.12 ^{bc}	0.30 ^b	4.55 ^d
T6	0.72 ^{abc}	2.07 ^{abc}	2.10	0.11 ^{bc}	0.32 ^b	5.11 ^{abcd}
T7	0.62 ^c	1.98 ^{abc}	2.33	0.13 ^{bc}	0.29 ^b	4.89 ^{cd}
T8	0.65 ^c	2.29 ^{ab}	2.75	0.14 ^{bc}	0.26 ^b	5.96 ^a
T9	0.82 ^{ab}	2.05 ^{abc}	2.64	0.14 ^{bc}	0.34 ^b	5.68 ^{abc}
T10	0.64 ^c	2.36 ^a	3.09	0.15 ^b	0.29 ^b	5.70 ^{abc}
SEM	0.22	0.68	0.07	0.01	0.01	0.14

Means of column with different superscript differ significantly (P<0.05)

Table.5 Processing losses (% of live weight) of broilers in different treatment groups

Treat.	Parameters (%)					
	Blood	Feather	Head	Separable fat	Appendages	Processing losses
T0	7.96 ^a	6.67 ^{bcd}	2.87 ^{ab}	1.26	6.06 ^b	24.80 ^{ab}
T1	6.06 ^{cde}	6.06 ^{cd}	2.95 ^a	1.30	6.05 ^b	22.42 ^{cd}
T2	5.20 ^f	5.82 ^d	3.01 ^a	1.41	5.82 ^{de}	21.25 ^{de}
T3	5.29 ^{ef}	6.69 ^{abcd}	2.50 ^{de}	1.35	5.70 ^{def}	21.53 ^{cde}
T4	6.78 ^{bc}	6.62 ^{bcd}	2.64 ^{cd}	1.30	6.03 ^{bc}	23.37 ^{bc}
T5	5.41 ^{ef}	5.86 ^d	2.45 ^e	1.37	5.06 ^g	25.14 ^a
T6	6.28 ^{cd}	7.30 ^{abc}	2.51 ^{de}	1.11	5.57 ^f	22.77 ^{cd}
T7	5.92 ^{def}	7.45 ^{ab}	2.58 ^{cde}	1.42	5.85 ^{cd}	23.20 ^{bcd}
T8	6.38 ^{cd}	6.48 ^{bcd}	2.73 ^{bc}	1.40	5.65 ^{ef}	22.63 ^{cd}
T9	5.68 ^{def}	6.23 ^{bcd}	2.55 ^{de}	1.40	6.28 ^a	22.14 ^{cd}
T10	7.31 ^{ab}	7.94 ^a	2.89 ^{ab}	1.26	6.36 ^a	25.74 ^a
SEM	0.19	0.16	0.04	0.04	0.07	0.35

Means of column with different superscript differ significantly (P<0.05)

Table.6 Economics (feed cost/kg body weight gain) of broiler production in different treatment groups

Treat.	Feed cost/kg (Rs)	Feed cost/kg body weight gain (Rs)
T0	30.05	53.86 ^a
T1	30.07	52.52 ^{ab}
T2	30.08	51.63 ^{bc}
T3	30.07	51.02 ^{bcd}
T4	30.09	50.21 ^{cd}
T5	30.09	46.39 ^f
T6	30.12	49.72 ^{de}
T7	30.09	48.24 ^e
T8	30.13	48.49 ^e
T9	30.09	52.40 ^{ab}
T10	30.12	52.08 ^b
SEM	0.01	0.35

Means of column with different superscript differ significantly (P<0.05)

In resemblance with our study, Adeyemo and Akanmu (2012), concluded that supplementation of diet with 1.0% NLM+PLM could improve dressing percentage of broiler. Similarly, Onyimonyi and Onu (2009) also observed that 2.0%

inclusion of papaya leaf meal in the diet of finishing broilers could improve carcass yield in broilers. These findings were in corroboration with Shihab *et al.*, (2017), who observed that broilers fed neem powder (1.0-3.0 g/kg feed) can show significant

improvement in dressing percent and carcass weight of broilers. In a previous study of Bonsu *et al.*, (2012), they also reported no significant ($P>0.05$) effect of NLM diets (1.5-2.5 % of total diet) on the percentage of internal organs of broilers across dietary treatments. By this we can state that since carcass yield is a sign of the quality and utilization of feed (Bamgbose and Niba, 1998), birds on Treatment 5 in our study had utilized their diet better, which was demonstrated by increased carcass yield.

Effect of supplementation of neem and papaya leaf meal on organs weight (% of dress weight) of broilers

Current study revealed that birds supplemented with varied levels of neem and papaya leaf meal produced significant ($P<0.05$) change in internal organ weight of broilers. But in absence of any specific trend across dietary treatment, weight of organs seems to have no effect of neem and papaya leaf meal supplementation (Table 4).

Findings of the present study showed an agreement with Adeyemo and Akanmu (2012), where they observed that after supplementation of diet with 1.0% NLM+PLM, % weight of liver, heart, gizzard and lungs did not differ significantly ($P>0.05$), this might be because of the lowered level of anti-nutritional factors like limonoids (azadirachtin, salanin, nimbin, nimbidiol, etc.), which are triterpenoid compounds in the diet at this level of supplementation. Higher physiological activities by these organs are triggered by the presence of anti-nutritional factors and their associated effects. Contrary to present findings, Ahaotu *et al.*, (2018) incorporated papaya leaf meal at levels of 0%, 5%, 10%, and 15% in broiler diet and reported that % weight of gizzard, liver and heart were significantly ($P<0.05$) increased on papaya leaf meal supplementation.

Effect of supplementation of neem and papaya leaf meal on processing losses (% of live weight) of broilers

Current study revealed that diet fed with neem and papaya leaf meal in 1:1 ratio at 1.0% of total diet (T5) and in 2:1 ratio of 2.0% of total diet (T10) had shown significantly ($P<0.05$) maximum processing losses (25.14% and 25.74%) compared to other groups (21.25-24.80%). Overall processing losses in terms of head, blood, feather, separable fat and appendages (% of live weight) showed that broilers supplemented with neem and papaya leaf meal have significant influence ($P<0.05$), but no specific trend has been observed which indicates no effect of treatment (Table 5).

Findings of the present study was in agreement with Haruna and Odunsi (2018) who supplemented papaya latex @ 0, 0.1, 0.15 and 0.2% to broilers and reported that there were significant variations ($P<0.05$) in the cut up parts (thigh, breast, neck, wing, back, drumstick and abdominal fat) without establishing any specific trend.

They observed that in a balanced and quality diet, papain enzyme might have no significant effect on carcass characteristics of broilers (Bharathidhasan *et al.*, 2009, Hana *et al.*, 2010, Davood *et al.*, 2012, Azarfar, 2013 and Dalolio *et al.*, 2015). In contrary to current study, Adeyemo and Akanmu (2012) reported that supplementation of diet with 1.0% NLM+PLM in broiler, did not significantly ($P>0.05$) influenced the % weight of head and appendages.

Effect of neem and papaya leaf meal on economics of broiler production

As per the cost of ingredients used to prepare different diets in present study revealed that supplementation of neem and papaya leaf meal did not significantly ($P>0.05$) influenced the economics of broiler production in terms

of feed cost/kg but significantly ($P<0.05$) influenced feed cost/kg body weight gain by different treatment groups. Data is presented in Table 6.

The better feed cost/kg body weight gain of group T5 could be attributed by better growth performance and improved feed conversion ratio due to addition of neem and papaya leaf meal in broiler diet. These findings corroborated with the observations of Onyimonyi *et al.*, (2009) who fed neem leaf meal at 0.5-2.5% of diet and Bonsu *et al.*, (2012), who fed neem leaf meal at 1.5-2.5% dietary levels, found drop in production cost per bird, increased live weight, better FCR and higher gross profit in treated groups as compared to control group. Likewise, Deka *et al.*, (2019) recommended that neem leaf powder at the level of 0.3% can be used economically as a natural feed additive in broiler chicken diet.

Similarly, Onyimonyi and Onu (2009) reported that broilers up to 2.0% inclusion level of papaya leaf meal could bring more economic returns to the farmer as evidenced by significantly lowered ($P<0.05$) feed cost/kg gain.

All these studies were in corroboration with the results of present study and stated that supplementation of neem and papaya leaf meal combination at lower level could be economical to farmers in terms of returns through broiler meal.

In conclusion the results revealed that by including neem and papaya leaf meal in the ratio of 1:1 at 1.0% of total diet in broilers has growth and health improvement potential and could be used as a feed additive for broiler production. The advantage of using neem and papaya leaf meal as a growth promoter is that these plants are readily available in India and can be easily collected at relatively no cost.

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